

REMARKS

This application has been reviewed in light of the Office Action dated August 22, 2002. Claims 1-20 are now presented for examination. Claims 1-7 and 9-11 have been amended to define more clearly what Applicants regard as their invention.¹ New Claims 12-20 have been added to provide Applicants with a more complete scope of protection. Claims 1, 3, 7 and 11 are in independent form. Favorable reconsideration is requested.

Claim 10 was objected to because, according to the Office Action, the phrase "the surface plate" lacks antecedent basis. Claim 10 has been amended as deemed necessary to overcome this objection, and thus withdrawal of the objection is respectfully requested.

Claim 10 was rejected under 35 U.S.C. § 112, first paragraph, as being based on a disclosure which allegedly is non-enabling. In particular, the Office Action asserts that "[t]he location of the leakage magnetic field shield between the magnetic force generator and the electron beam column is critical or essential to the practice of the invention, but not included in the claim(s), which is therefore not enabled by the disclosure."

¹/ The amendment to Claim 1 is support by, for example, Claim 7 as originally filed, and the amendment to Claim 2 is supported by page 14, lines 10-14 of the specification. Claim 12, as amended, recites a feature formerly recited in Claim 1 as originally filed, and Claims 13 and 19 are supported in the specification at page 16, lines 18-24. Claims 14 and 20 are supported from page 14, line 26 to page 15, line 4 of the specification, Claim 15 is supported by page 14, lines 10-14 of the specification, and Claim 16 is supported by Fig. 15. Also, Claim 17 is supported by Fig. 18, and Claim 18 is supported by page 14, lines 10-14 of the specification.

Section 112, first paragraph, requires that "[t]he specification . . . contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains . . . to make and use the same" Applicants respectfully assert that one skilled in the art would most certainly be able to make and use the invention defined in Claim 10 in view of the originally filed specification.

For example, from page 19, line 18 to page 20, line 2, the specification refers to increasing a leakage magnetic field shield effect, a distance t_1 between a surface plate 18 and plate magnets 25 serving as magnetic force restraints, and a distance t_2 between the surface plate 18 and magnetic field shield 21, as shown in, for example, Fig. 9. The magnets 25 and shield 21 preferably are arranged relative to the surface plate 18 such that $t_1 > t_2$. Clearly, these features support the subject matter of Claim 10, which now recites "letting t_1 be a distance between a surface plate for guiding said magnetic force generator and a surface, opposing the surface plate, of said magnetic force generator, and t_2 be a distance between an edge portion of said magnetic field shield and the surface plate, a relationship $t_1 > t_2$ is satisfied."² As one skilled in the relevant art also would clearly appreciate in view of the mentioned portion of the specification and Fig. 9, there is no critical or essential requirement that "the leakage magnetic field shield [be located] between the magnetic force generator and the electron beam column", as alleged in the Office

^{2/} Of course, Claim 10 should not be construed as being limited merely to the specific exemplary embodiment described in the mentioned portion of the specification.

Action, and Claim 10 recites merely the relative spatial arrangement of the magnetic force generator, magnetic field shield, and surface plate.

It is believed that the rejection under Section 112, first paragraph, has been overcome, and its withdrawal is therefore respectfully requested.

Claims 7-9 and 11 were rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 4,607,167 (Petric). Applicants respectfully request reconsideration of this rejection in view of the following comments.

Independent Claim 7 is directed to a stage used in an electron beam lithography apparatus, comprising a sample stage on which a sample is placed, a magnetic force generator for applying a pre-load to the sample stage, and a magnetic field shield for shielding a magnetic field from the magnetic force generator.

Independent Claim 11 is directed to an electron beam lithography method using an electron beam lithography apparatus comprising an electron optical lens-barrel having an electron lens for converging an electron beam and a deflector for deflecting the electron beam, a surface plate, a sample stage movable on the surface plate, a magnetic force generator for applying a pre-load to the sample stage, and a magnetic field shield for shielding a magnetic field from the magnetic force generator. The method comprises the steps of placing a sample on the sample stage, and directly drawing a pattern on the sample using the electron beam.

The stage recited in Claim 7 comprises a sample stage, a magnetic force generator for applying a pre-load to the sample stage, and a magnetic field shield for

shielding a magnetic field from the magnetic force generator. The method recited in Claim 11 recites features that are similar in many relevant respects to those of Claim 7.

Petric relates to a charged particle beam lithography machine including a beam source and beam steering and forming elements within an evacuated column. A stage assembly and a vacuum envelope apparatus are included.

The Office Action contends that either the linear reluctance or inductance motor of Petric corresponds to the magnetic force generator recited in Claims 7 and 11. However, in Applicants' view, the linear motor of Petric is arranged to move a wafer holding stage 30 in the X-Y plane and does not apply a pre-load to the stage 30. In the present invention, on the other hand, a pre-load may be applied such that the sample stage is attracted to the surface plate, or the pre-load may be applied in a Z-direction. Nothing has been found, or pointed out Petric that would teach or suggest a magnetic force generator arranged to apply a pre-load to a sample stage, as recited in Claims 7 and 11.

Moreover, an internal conical surface member 24' of the vacuum envelope 20 of Petric is not seen to correspond to the magnetic field shield of the present invention and recited in Claims 7 and 11. The conical surface member 24' of Petric is not located as a component of the stage 30, but instead is located in the electron beam column for shielding the working beam. In contradistinction to member 24', the magnetic field shield of Claims 7 and 11 is arranged to shield a magnetic field from the magnetic generator applying a pre-load to the sample stage. Petric is not seen to teach or suggest these features.

For the foregoing reasons, Claims 7 and 11 are each deemed clearly patentable over Petric

Claims 1-6 were rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,072,251 (Markle) in view of Petric.

Independent Claim 1 is directed to an electron beam lithography apparatus including an electron optical lens-barrel having an electron lens for converging an electron beam and a deflector for deflecting the electron beam, a sample chamber for holding a sample to be subjected to lithography in a vacuum state, and a sample stage on which the sample is placed. The apparatus comprises a magnetic force generator for applying a pre-load to the sample stage, and a first magnetic field shield for shielding a magnetic field from said magnetic force generator to an internal space in the sample chamber.

An aspect of the invention to which Claim 1 relates is the magnetic force generator for applying a pre-load to the sample stage, in addition to the magnetic field shield.

Markle teaches Halbach magnet arrays 798 mounted on a lower surface of a stage 600. However, the magnet arrays 798 are arranged to move the stage 600 by generating a Lorentz force. Thus, Markle is not seen to disclose or suggest a magnetic force generator arranged to apply a pre-load to a sample stage, as recited in Claim 1.

Also, for the reasons given above, Petric also is not seen to teach or suggest such a magnetic force generator.

Therefore, Applicants respectfully submit that Claim 1 is clearly patentable over Markle and Petric, whether considered separately or in combination.

Independent Claim 3 is directed to an electron beam lithography apparatus including an electron optical lens-barrel having an electron lens for converging an electron

beam and a deflector for deflecting the electron beam, a sample chamber for holding a sample to be subjected to lithography in a vacuum state, and a sample stage on which the sample is placed. The apparatus comprises a single-axis electromagnetic driver for electromagnetically driving the sample stage in a single direction, and a first magnetic field shield for shielding a magnetic field from the electromagnetic driver to an internal space in the sample chamber.

An aspect of the invention to which Claim 3 relates is an electron beam lithography apparatus that includes a single-axis electromagnetic driver for electromagnetically driving the sample stage in a single direction, and a first magnetic field shield for shielding a magnetic field from the electromagnetic driver to an internal space in the sample chamber. The electromagnetic driver is arranged to drive the sample stage in a single direction, and therefore the first magnetic field shield to be arranged to cover or surround the electromagnetic driver may have a small area, e.g., an area defined by a length in the driving direction and a width in a direction perpendicular to the driving direction.

The teachings and deficiencies of Petric were described above.

In contrast to the present invention, Markle's driver (798, 500, 502, 812, 814, 816 and 818 in Fig. 16) for moving a stage 600 is arranged in two dimensions to move the stage 600 in two dimensions. Therefore, Markle's driver requires each of the shields 822 and 824 to have a large area for shielding the magnetic field, i.e., an area defined by both an X-stroke (length in X-direction) and a Y-stroke (length in Y-direction).

Applicants respectfully submit that, in their view, nothing has been found, or pointed out, in either Markle or Petric, that would teach or suggest a single-axis

electromagnetic driver having features as recited in Claim 3, and thus Claim 3 is deemed clearly patentable over those references, whether considered separately or in combination.

A review of the other art of record has failed to reveal anything which, in Applicants' opinion, would remedy the deficiencies of the art discussed above, as references against the independent claims herein. Those claims are therefore believed patentable over the art of record.

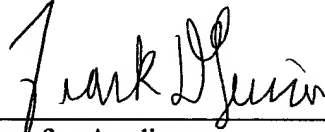
The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual consideration or reconsideration, as the case may be, of the patentability of each on its own merits is respectfully requested.

In view of the foregoing amendments and remarks, Applicants respectfully request favorable reconsideration and early passage to issue of the present application.

Applicants' undersigned attorney may be reached in our New York office by

telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,



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